FHIR
and JSON

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This presentation

- Based on presentations by the 3 core architects of FHIR:
  - ➤ Grahame Grieve, Australia
  - ➤ Ewout Kramer, The Netherlands
  - ➤ Lloyd McKenzie, Canada

- Creative Commons, specifically:
  - ➤ Creative Commons Attribution 3.0 Unsuported License
  - ➤ (Do with it as you wish, so long as you give credit)

FHIR in one slide

- **F**ast **H**ealthcare **I**nteroperable **R**esources
- New *free and open* healthcare data API
- Builds on simplicity of HL7 V2
- With modern (web) standards
  - ➢ XML, JSON, HTTP, REST, UML
  - ➢ Familiar to new generation of developers
- Easy to implement the basics
- Getting rapid take up

FHIR in one bullet

- **FHIR is:**

    a set of XML (and/or JSON) health data resources, plus a REST API for accessing them.

- Probably two unfamiliar acronyms there:
    - JSON is an increasingly popular alternative markup to XML
    - REST is the name for accessing data via basic HTTP read/write/update operations

Examples

- FHIR allows XML (or JSON) data to be read from and written to URLs, via HTTP, in a controlled, organized manner.

  Lets see some XML…

This is what a FHIR Patient resource looks like in XML

```xml
<?xml version="1.0" encoding="utf-8"?>
<Patient xmlns="http://hl7.org/fhir">
    <text>
        <status value="generated" />
        <div xmlns="http://www.w3.org/1999/xhtml">
            <p>Harley Hobbs</p>
            <p>16 Pier Road</p>
            <p>Salisbury</p>
            <p>SY4 7IW</p>
            <p>Date of birth: 1966-06-07</p>
        </div>
    </text>
    <identifier>
        <use value="official" />
        <label value="SSN" />
        <system value="http://hl7.org/fhir/sid/us-ssn" />
        <key value="1" />
    </identifier>
    <name>
        <use value="official" />
        <family value="Hobbs" />
        <given value="Harley" />
    </name>
    <birthDate value="1966-06-07" />
    <address>
        <use value="home" />
        <text value="16 Pier Road, Salisbury, SY4 7IW" />
        <line value="16 Pier Road" />
        <city value="Salisbury" />
        <zip value="SY4 7IW" />
    </address>
</Patient>
```

REST: URL based API

- Use REST to get patient #1 from a FHIR server

resource type

`https://server.nhs.org/Patient/1`

secure http protocol   endpoint   identifier

REST: JSON

- JSON is an alternative format to XML

- To use REST to read the same patient, but get it in JSON instead:

  `https://.../Patient/1?_format=json`

Patient resource in JSON

```json
{
    "resourceType": "Patient",
    "text": {
        "status": "generated",
        "div": "<div xmlns='http://www.w3.org/1999/xhtml'><p>Harley Hobbs</p>...."
    },
    "identifier": [{
        "use": "official",
        "label": "SSN",
        "system": "http://hl7.org/fhir/sid/us-ssn",
        "value": "1"
    }],
    "name": [{
        "use": "official",
        "family": ["Hobbs"],
        "given": ["Harley"]
    }],
    "birthDate": "1966-06-07",
    "address": [{
        "use": "home",
        "text": "16 Pier Road, Salisbury, SY4 7IW",
        "line": ["16 Pier Road"],
        "city": "Salisbury",
        "zip": "SY4 7IW"
    }]
}
```

REST: Searching

- Search is a also via URL

query

`https://.../Patient/search?name=Smith`

This URL searches patient resources.

Step back - why FHIR?

- HL7 V3 works, but is too hard
- Documents aren't enough for all use cases
- HL7 V2 needs a transition path
- The world has evolved
- New markets, web, mobile, cloud

New markets, new questions

- "How can I get data from my server to my iPhone app?"

- "How do I connect my applications using cloud storage?"

- "How can I give standardized record level access to my PHR product?"

- "How can I get my PAS to talk to my Community health system?"

Left screen (4:47):

PATIENT VIEWER

COLLINS, CLAIRE ELI
21 Ulinga Crescent 8 Bimbah Street ALGEST
1997-01-23   Female

Home
21 ULINGA CRESCENT
8 BIMBAH STREET
ALGESTER
4115

Home
153-6156

Medicare Card   PLS Patient ID
Number   916610
22062340191

Medications

Penicillin VK oral suspension 125mg/5ml
10.0 ml oral administration of treatment
on 2/06/2012 12:30 AM

http://spark.furore.com/fhir/patient/@916610

Right screen (4:48):

PATIENT VIEWER

Collins, Calvin
99 Booth Drive, Merricks, 3916
1992-12-29   Male

Home
99 Booth Drive
Merricks
Victoria
3916

Home   Mobile
5975 9999   0419 999 999

Medications

Penicillin VK oral suspension 125mg/5ml
10.0 ml oral administration of treatment
on 2/06/2012 12:30 AM

Penicillin VK oral suspension 125mg/5ml
10 ml oral administration of treatment
on 1/06/2012 2:30 PM

http://spark.furore.com/fhir/patient/@10000

Freely available

- **Unencumbered – free for use**
  - Free as in beer (gratis)
  - and as in speech (freedom)
  - If you are looking for the simple free open health API, this is it

- http://hl7.org/fhir

FHIR License 1.0.3

FHIR plain English license:

- FHIR is © HL7. The right to maintain FHIR remains vested in HL7
- You can redistribute FHIR
- You can create derivative specifications or implementation-related products and services
- Derivative Specifications cannot redefine what conformance to FHIR means
- You can't claim that HL7 or any of its members endorses your derived [thing] because it uses content from this specification
- Neither HL7 nor any of the contributors to this specification accept any liability for your use of FHIR

Principles: keep it simple

- You should be able to "figure it out" over a weekend.

- Easy to get started, grow into the spec for more complex scenarios

- *FHIR is interoperability for people who have other things to do*

FHIR supports "common" scenarios

- FHIR is kept readable by focusing on the most common use cases

- Inclusion of content in core specification is based on an "80%" rule

  - ➤ If it isn't used by 80% of implementers, it doesn't go in

  - ➤ Makes it easy to get started, not bogged down in the less common details

  - ➤ The remainder is not ignored: 100% coverage is achieved by having by non-core "extensions". *You don't need to understand those to get started.*

Existing technologies

- **XML and/or JSON - for data**
- **REST API – http web calls**
  - like Amazon, Facebook, Twitter
  - read/write data via URLs (web addresses).
- **UML class diagrams - for models**
- **XSD, Schematron - for validation**
- **HTTPS, OAuth – industry standard security**

Implementer Focus

- Specification is written to be implemented
- Implementers have been forgotten recently
  - You can design what you want, but if I can't be built…
  - FHIR is tested by implementation *before publication*
- Publicly available test servers
- Working code is published with the specification
  - C#, Java, …
- Connectathons, verify specification works
- Lots of examples, easy to understand

FHIR Resources

- "Resources" are:
  - Small logically discrete units of exchanged data
  - Defined behaviour and meaning
  - Known identity / location
  - Smallest unit of transaction

What's a Resource?

FHIR
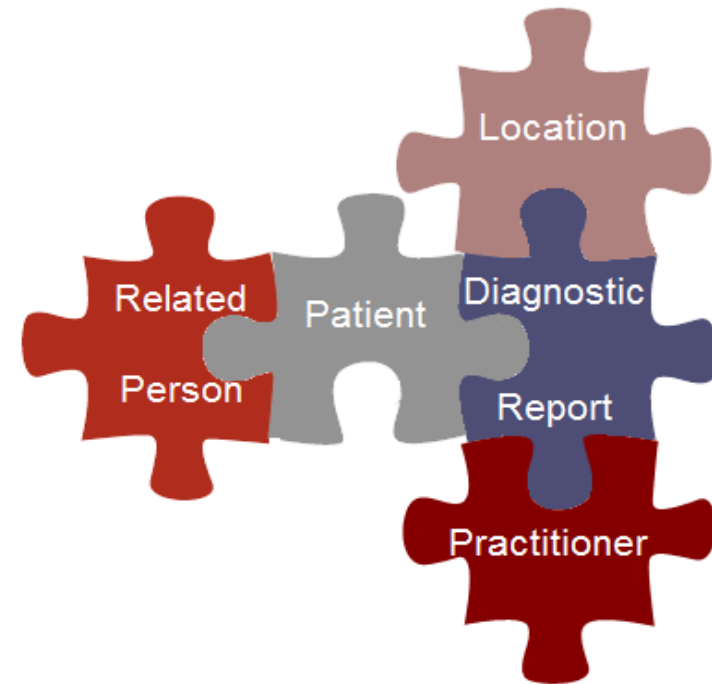
Examples

- Administrative
  - **Patient**, **Visit**, Organization, Invoice
- Clinical Concepts
  - **Allergy**, **Problem**, Questionnaire, Care Plan
- Infrastructure
  - **Document**, Message, Profile, Conformance

Counter examples

- Gender
  - Too small
- Electronic Health Record
  - Too big
- Blood Pressure
  - Too specific (see *profiles*)
- Intervention
  - Too broad

Resource diagram

Patient

Patient (R)
- link : Resource(Patient) 0..*
- active : boolean 0..1
- identifier : Identifier 0..*
- provider : Resource(Organization) 0..1
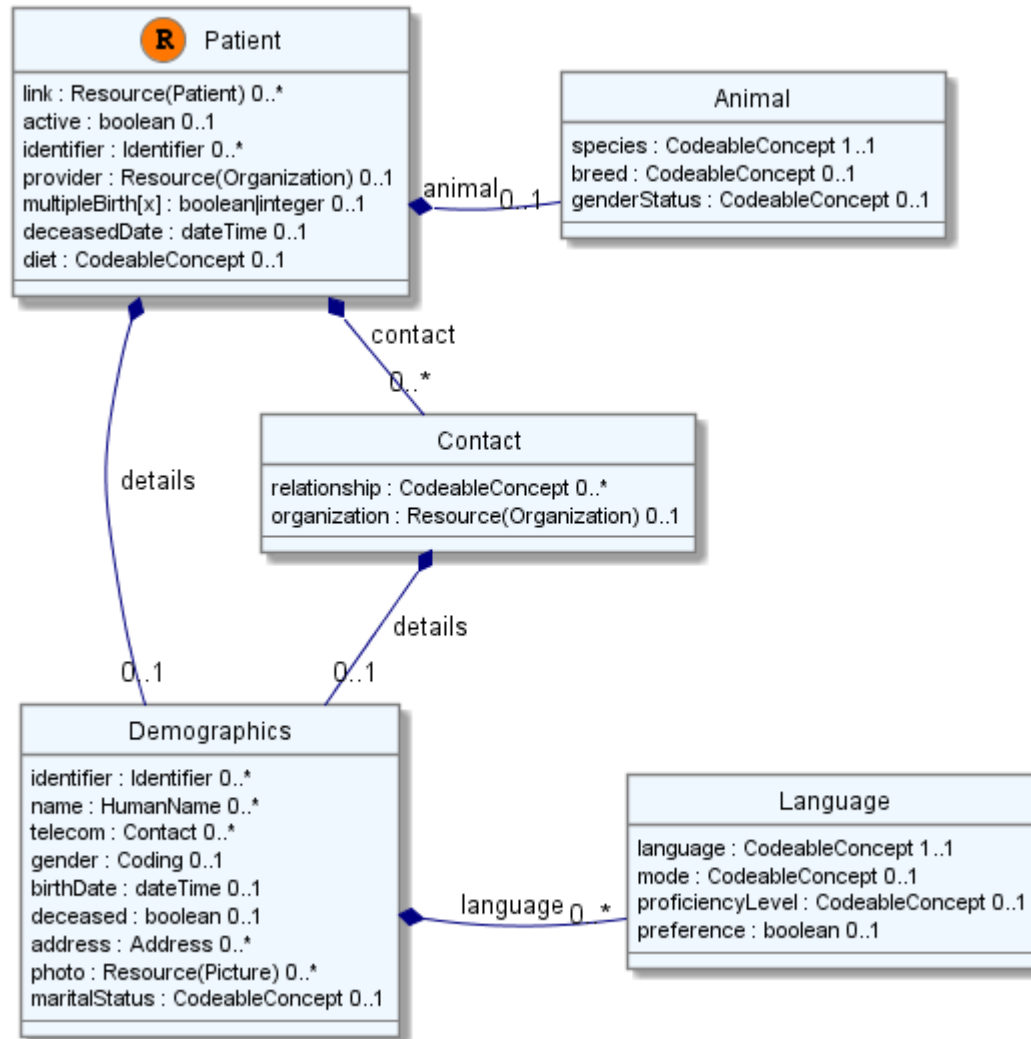- multipleBirth[x] : boolean|integer 0..1
- deceasedDate : dateTime 0..1
- diet : CodeableConcept 0..1

Animal
- species : CodeableConcept 1..1
- breed : CodeableConcept 0..1
- genderStatus : CodeableConcept 0..1

animal 0..1

contact 0..*

Contact
- relationship : CodeableConcept 0..*
- organization : Resource(Organization) 0..1

details 0..1

details 0..1

Demographics
- identifier : Identifier 0..*
- name : HumanName 0..*
- telecom : Contact 0..*
- gender : Coding 0..1
- birthDate : dateTime 0..1
- deceased : boolean 0..1
- address : Address 0..*
- photo : Resource(Picture) 0..*
- maritalStatus : CodeableConcept 0..1

Language
- language : CodeableConcept 1..1
- mode : CodeableConcept 0..1
- proficiencyLevel : CodeableConcept 0..1
- preference : boolean 0..1

language 0..*

Human Readable

- Success of CDA (documents) taught HL7 a very important lesson
  - Its hard to make computers understand data
  - but that's ok if they can properly render it to a human clinician
- This doesn't just hold for documents
  - important for messages, services, etc.
- In FHIR, **every** resource is required to have a human-readable expression
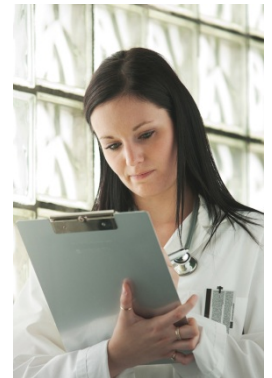
REST

- The API in FHIR

- Use HTTP to do "*CRUD*" operations (create, read, update, delete) on resources (records).

- The REST interface is what adds the *API* onto the *content* of the resources.

- The data is not a website*, but it is convenient to treat it like one.*

- Normal security can be applied via HTTP, firewalls etc.

REST Alternatives

- REST is a key advantage of FHIR
- Inherently simple, adds the transactional behaviour needed
- Resources not limited to being served via a REST API
- Other paradigms: documents, messages, services
  - Fully documented as part of FHIR
- Same FHIR resources are used
  - e.g. Receive a lab result in a *message*. Package it in a discharge summary *document*

FHIR Project Timeline

- First invented July 2011

- First presented San Diego Sept 2011

- Draft for Comment Sept 2012

- Connectathons since Sept 2012

- Formal Ballot Sept 2013 (1000s comments received)

- **DSTU publication in Jan 2014**

  - "Draft Standard For Trial Use" – ANSI rules

  - It's ready to use, we all gain experience, may lead to some changes

Current state of FHIR

- 5 completed international Connectathons
- IHE & DICOM both exploring use of FHIR
  - Likely to be format of MHD (IHE Mobile XDS profile)
- NHS HSCIC using as basis for E-Referrals project
  - Other UK projects in the pipeline
- US Government (ONC) also working with FHIR
- Many suppliers looking at FHIR (connectathons and development meetings), almost certainly implementing it
- One commercial Integration Engine supports FHIR. Several other IE vendors are actively involved in the creation of FHIR.

Getting ready

- ## Get familiar with FHIR

- ## Consider FHIR for new requirements

  - e.g. Expose appointments or lab data to patients on their smart phones
  - Compare NHS numbers between systems (SHSW goal)

- ## Map existing internal interfaces to FHIR to allow easy external interfacing

- ## Look at adopting FHIR as an internal architecture

Next steps for **you**

- Read the spec: http://hl7.org/fhir
- Comment on the spec: discussion thread on each page
- Join the FHIR email list
http://wiki.hl7.org/index.php?title=FHIR_email_list_subscription_instructions
- Follow #FHIR on Twitter
- Try implementing it
- Come to a Connectathon!
- Get some training…

HL7 UK Training

- HL7 FHIR 'Hands-on' - 12th March and 12th November 2014
  - Gain hands-on experience with HL7 latest standard for mobile and cloud based applications.
- IHE XDS Enterprise archiving, VNA and ECM - 28th-29th April and 10th-11th Nov 2014
- HL7 ITK (Interoperability Toolkit) - 26th-27th March and 22nd-23rd October 2014
- HL7/IHE/DICOM/CDA Standards Overview - 30th April 2014 and 13th November 2014
- HL7 Version 2 - 24th-25th March and 20th-21st October 2014

- http://www.hl7.org.uk/marketing/training/training_summary.asp

FHIR

- http://hl7.org/fhir - FHIR home

- http://hl7.org.uk - FHIR UK activity

- Twitter: #FHIR

- Live demo:
  http://nprogram.azurewebsites.net/